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DEPARTMENT OF THE ARMY
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FORT MONROE, VIRGINIA 23651

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25 January 1979

SUBJECT: Tactical Imagery Exploitation

HQDA (DAMO-RQ)
WASH, DC 20310

1. References:

a. TRADOC SPINTCOM message, DTG 231359Z Oct 78, Subject: Tactical Imagery Exploitation.

b. TRADOC letter, 26 September 1978, Subject: TRADOC Battlefield Automation System (BAS) Evaluation and Recommendation for MAGIIC.

2. At Inclosure 1 is the interim TRADOC Imagery Intelligence Architecture. This is the product of the effort outlined in paragraph 5 of Reference 1a. It may be of some use in preparing for Congressional hearings on Intelligence Related Activities. The Architecture delineates the battlefield commander's functions by echelon (EAC, Corps, Division) and relates the role of imagery to these functions.

3. The deliberations leading to this architecture were undertaken to provide a basis for the TRADOC recommendations on MAGIIC procurement due at HQDA 15 February 1979 (cf. Reference 1b). This paper gives a very basic review of the dynamic field of imagery and is our first attempt to objectively correlate the Army's requirements for/uses of imagery with its tactical missions. The paper does not attempt to address personnel skill level requirements; cost versus operational effectiveness questions or current technological state of the art and only briefly touches on the major problems of communications and multi-national interoperability. These problems will be addressed as the architectural effort continues.

FOR THE COMMANDER:

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1 Incl
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(U) IMAGERY INTELLIGENCE ARCHITECTURE

Section I. Purpose.

A. Introduction.

(1) The modern battlefield has greatly changed in a few short years. Intensity and lethality have taken quantum leaps. Weapons systems exceed what any WWII commander could have ever conceived. WWII tanks guns could penetrate 4.8 inches of armor; today's tank guns penetrate 9.5 inches of armor at ranges that have doubled. Artillery, which caused more than half of the casualties of WWII, was employed by the Soviets in 1945 with 250 guns per KM at Vistula-Oder. Today the WWII range of such massive firepower has increased to 18 KM while the lethality of the shell has grown five times and the area of coverage has leaped from 7500 square meters to 25,000 square meters. In 1945 the Soviets had about 85 air defense weapons per division; today there are more than 140 with an increase in effectiveness from about 12,000 meters in WWII to 40,000 meters today. An Infantry squad can cover 30 KM on foot in five hours; in an APC, the same distance can be covered in 2 hours, and if airmobile, in 15 minutes. At that rate the squad could be moved 120 KM by air in one hour. In 1945, a Soviet division's initial objective was at a depth of 3-5 KM with the final days objective at 18-24 KM. Today the point of that division's initial objective is 15-20 KM with the day's objective at 35-40 KM. The point of the foregoing comparisons is that the tactical commander on the modern battlefield will be pressed by time, space and highly sophisticated weapons/troops. The dynamics of the future battlefield requires the tactical commander to "see" to greater depths and receive information and intelligence in a more timely manner than ever before.

(2) One means of obtaining an overall dynamic picture of the battlefield is through the use of imagery intelligence (IMINT) in conjunction with other intelligence disciplines. The purpose of this paper is to describe the uses and importance of IMINT to the tactical commander, and to define the types of IMINT data and where it should be exploited and used by commanders at echelons above corps, corps, and division. Additionally, this paper will identify how the US Army is approaching the design of these future developments to enable the tactical commander to "see" the battlefield.

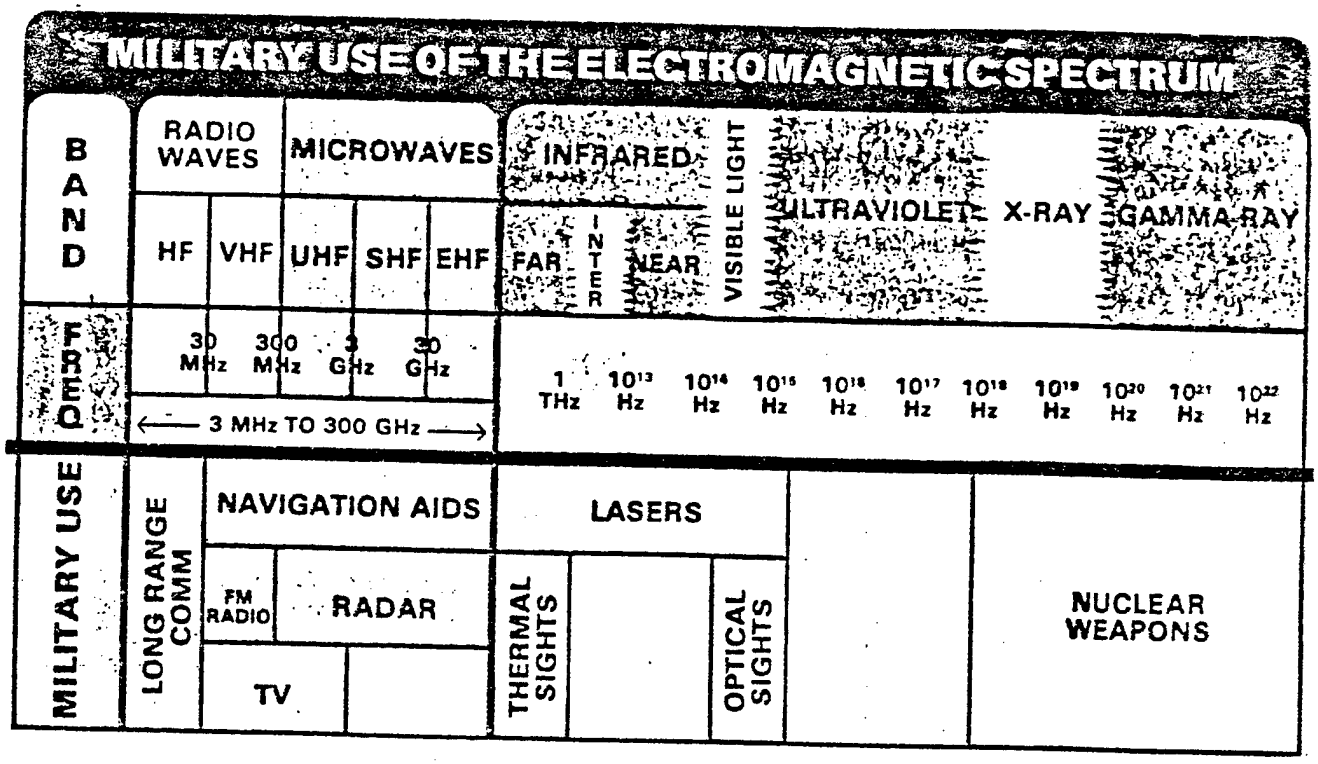
B. Terms of Reference.

(1) A common occurrence in any discussion relative to Imagery is an erroneous exchange of the terms photography and imagery. These terms do not mean the same thing but are often treated as synonymous, leading to misunderstandings and misconceptions. Imagery sensors can

function throughout the electromagnetic spectrum from radio waves to X-Rays. Photography only uses the visible light spectrum. Thus, photography, while the classic product of aerial reconnaissance, is only a part of the totality of imagery. The term imagery includes such technologies as Side-Looking Airborne Radar (SLAR), Infrared (IR), Synthetic Aperture Radar (SAR), Electro-optical (EO), Photography and Microwave Radiation (MICRAD). As advancing technology has expanded the capabilities of these additional forms of imagery for military use, the methods of transmission of collected imagery, as well as exploitation, have advanced. Digital imagery is a reality today. In the late 1980's the technological capabilities to acquire, process, transmit, and exploit imagery in near-real-time (NRT) digital format will represent a quantum step forward. Our historical experiences with photography acquired by a standard film base camera are no longer valid. Silver halide, hardcopy photography, which must be returned to a ground site for laboratory processing prior to exploitation by an interpreter, no longer need be the prime source of imagery derived information. With the advent of NRT digital imagery, the classic disadvantages of time delay and centralized processing we have all known and experienced with photographic intelligence begin to disappear. Imagery acquired and transmitted by an electronic signal for reconstitution in a softcopy digital format can now become a key factor in developing the combat commander's picture of the battlefield.

(2) An equally important advancement is occurring in sensor development. For the first time in the history of imagery developments, we stand at the threshold of acquiring a true all-weather, day/night sensor. For almost 100 years our knowledge and experience with "seeing" behind the enemy's front lines have been limited to visual observation from an aerial platform or taking a picture with a film base camera. Now, in less than 15 years, technology has advanced to a state that will allow NRT imaging of an area of interest anytime, without regard to weather or light conditions. Further, as the imagery application of the entire band of the electromagnetic spectrum for military use increases, our sensor mix capability increases accordingly. With a larger variety of sensors to collect with, coupled with a wider range of sensor platforms, the amount of coverage by such sensors also increases. In the 1985 timeframe we will have the ability to select from a family of imaging sensors for our collection efforts. Our sensor platforms will offer a variety of coverage ranging from overhead high altitude, to standoff to penetration. As we cue/tip off our imagery sensors from other collectors we can expect to zero in on collection of specific information requirements rather than falling back on the classic "Hoover" method--that procedure whereby we fly a sensor over a broad area sweeping up all we can in hopes of finding something worthwhile.

(3) The battlefield commander has been limited in acquiring imagery information behind the front lines by the penetration capabilities of the aircraft, or in a standoff mode, by the depth that a sensor can



ONLY A SMALL PORTION OF THE ELECTROMAGNETIC SPECTRUM IS IN THE VISIBLE RANGE

FIGURE 1

see into the enemy's rear. Historically, these depths have fallen short of the commander's needs. In FM 100-5 we have stated that a corps commander needs to see the battlefield beyond the FEBA to 150 KM. Since the publication of that doctrine we have now learned that the corps commander's area of interest extends to as much as 300 KM behind the FEBA and perhaps even farther in specific cases. The developing sensor mix, coupled with the enlarged variety of sensor platforms, will provide the capability for imagery to "see" to these new depths. As the digital imagery collection systems now in development arrive on the battlefield, the corps commander's capability to see the battlefield in a timely manner, through manipulation of his collectors will be vastly improved.

(4) Commanders now think in terms of tanks having to fire one round to hit a target at 1500 meters instead of the 13 rounds required by a WWII tank. The transition in our thinking about tanks has been aided by a relatively gradual increase in capabilities. With imagery, we must make a sudden shift in our thinking to avoid preconceived notions based on knowledge of photographic intelligence. The technological advances in imagery are unlike anything we have seen in the past. As such, new, original and objective analysis is required if we are to take full advantage of what is offered.

C. Characteristics of Imagery.

(1) Imagery offers several unique characteristics which are unavailable from any other collection system or source. Imagery allows for very accurate point positioning and verification of information from other collectors. It provides a detailed picture of the overall battlefield and a very detailed picture of particular geographic locations placing the target in context of its environment. It allows for detection of camouflage and deception efforts. Perhaps most importantly, imagery is enemy independent. The enemy does not have to cooperate to be imaged. With a standoff platform, the enemy may never know when he has been imaged so that in his field location, on the road, or even in garrison, his actual activity is captured by the imagery sensor. Imagery provides a great deal of data - a picture of several battalions of tanks on transporters in an assembly area is truly worth a thousand words. The new near-real and real-time imagery technologies can provide immediate information within seconds or minutes of the event thereby allowing the commander maximum flexibility in his selection of a course of action. Effective utilization of these characteristics was historically degraded by such factors as lack of timeliness, weather, available light and integration with the other collection sources. As discussed previously, technical advances will or have overcome many of these disadvantages. Integration of imagery systems with other collectors is not, however, only a technical problem. There is the analytical viewpoint that states that the battlefield commander does not need exploitable imagery, but only needs the information derived from exploitation of that imagery.

This really means that our experience shows that exploitable hardcopy silver halide photography is not satisfactory for the tactical army commander. This perception leads to the position that exploitation of imagery in support of a battlefield commander need not be done by organic assets. Exploitation can be done, according to advocates, by other services, joint image exploitation units, or even outside the theater. Historically and in actual practice that is exactly what is occurring today with regard to corps. Exploitation seldom occurs at the corps and when it does, it is sometimes days after the information was acquired. Exploitation generally occurs at the Air Force Tactical Reconnaissance Squadron (TRS), by either Army or Air Force interpreters, at a joint exploitation facility not organic to corps or in CONUS. Yet the emerging options offered by some as concepts for NRT imagery exploitation in the 1985 environment of digital imagery are still based on those unsatisfactory existing procedures even though they do not now support the combat commander's information needs. These options have evolved only from photographic intelligence performance and experience and ignore the very characteristics of imagery (immediacy, accuracy, coverage) we seek to take advantage of in 1985.

(2) The data acquired by effectively managed imagery collectors is valuable, perishable information. The longer it takes to put the information into the commander's all-source center the less value that information is to him. Further, since the information collected and reported to the commander can raise further questions relative to the report, the commander's ability to expand his original tasking for more specific information and to expect a timely response to that additional task should not be constrained. For example, a commander receives a SIGINT report indicating a new unit has occupied a position on a piece of key terrain. Using this information as a cue for a selected imagery system he establishes an Essential Element Information (EEI) that asks for confirmation of the unidentified unit(s) at that specific point. The NRT digital data from the selected sensor is received at the commander's exploitation facility and the report indicates a motorized rifle unit has indeed occupied the position in question. At this point numerous additional questions (e.g., what size, orientation, apparent readiness posture) will require immediate answers as the commander adjusts his plans and forces based on this confirmed change in enemy dispositions. His exploitation units, with the imagery in hand, can respond immediately to these additional tasks. The data contained on the imagery does not grow stale by several hours as it would if a msg stating additional requirements had to be sent over already overcrowded communications lines to a far distant exploitation unit, nor does the response for the additional information suffer a time delay in returning to the commander. This rather simplistic example serves to highlight not only the perishability of imagery data but the commander's need for control of NRT imagery for exploitation. Further, the example also spotlights the value of imagery characteristics such as geo-positioning, actual image of the target, and the enemy independent nature of imagery.

(3) Verification and expansion of information provided by other collection systems are major roles and key characteristics of imagery. Imagery systems responding in NRT to the battlefield commander can be directed to a specific suspect area with a high degree of confidence in successful satisfaction of the identified task. This verification is possible due to the invaluable characteristic of imagery as an enemy independent collection system. Enemy forces do not have to emit signals, move, or communicate to be imaged. In fact, for the enemy to avoid being imaged he must actively plan to do so. Historically, such avoidance was relatively easy in the world of photographic imagery. Clouds, foliage, simplistic camouflage or activities after daylight hours were effective neutralizing actions. Additionally the knowledge of the built-in time lags in photographic information being received by a commander who could act or, as was usually the case, could have acted, also detracted from the enemy's fear of being imaged. In the new world of imagery, with an NRT all-weather, day/night sensor capability, an enemy unit will be much more constrained in his imagery avoidance actions.

(4) Thus, the value of imagery information, now and in the future, is unquestioned. The commander needs information derived from imagery in order to see the battlefield and win the battle. Such information must be timely. While there are various source documents that attempt to establish empirical time lines for image information according to the function for which it will be used the fact remains that timeliness is a vague term that, at best, can only be described as situational dependent. Perhaps, the most realistic statement relative to timeliness of any intelligence data is that it must be available to the battlefield commander in enough time to bear on his tactical problems in order that he can make the right set of decisions to win each battle. If the need for imagery information in near-real-time is self-evident, then the basic issue to be addressed is where should imagery best be exploited in order to present the commander with the required imagery information in a timely manner. It is this issue that the remainder of this study will examine.

Section II. Imagery Utilization and Exploitation.

A. In the past the product resulting from airborne photographic reconnaissance was easily defined and understood. Photographs, as the basic medium, were uncomplicated and "readable" to a degree of detail limited only by training. With the advent of infrared and Side-Looking Radar, a transition in the basic medium began. Today that initial transition has expanded to cover a spectrum so broad as to render previous definitions of imagery untenable. Thus, imagery which could once be defined as a "likeness of an object produced on a photographic material"

or as "an exact likeness" must now be treated in terms of the rest of Webster's definition as "the optical counterpart of an object produced by an optical device or an electronic device" depicting a "tangible or visible representation" of an object/area. Imagery is no longer simplistic photography. Just as other technical advances have required redefinition of time honored concepts and perception the technological advances in imagery sensors and products require similar redefinitions.

B. What this means is that in the past the photo interpreter looked at a conventional photograph and reported what he actually saw, which in fact was a little bit of history since the objects/events he reported on were at least several hours, and usually, a few days old. The image analyst of today and the future views some sensor's representation of what is being sensed in real-time and has the capability of reporting in near-real-time the events actually taking place. Put differently, they do not report nine tanks which were at certain locations yesterday, but a tank company advancing at specific coordinates now.

C. The echelons of prime concern to this study are described below. The application of these echelons as frames of reference relative to the functions defined in Section IID below, forms the analytical base for the imagery matrix, Section IIE.

(1) Echelons Above Corps (EAC).

The Echelons Above Corps are principally concerned with a deep area of interest beyond corps interest. The mission, function and role of EAC are currently being defined. In general, EAC is expected to perform a macro-battle management function by planning and allocating resources for the battle 4 to 7 days hence. EAC is responsible for directing the destruction/disruption of enemy assets in the deep zone which can influence the battle. This will require targeting of long-range firepower such as long-range missiles and air interdiction means. EAC would be responsible to detect, identify, locate, and track movements of opposing 1st and 2d echelon front organizations, airborne and nuclear delivery units. EAC would have an interest in all intelligence which effects their zone of influence regardless of where such intelligence was collected and processed. EAC would function as the collection management authority (CMA) in satisfying corps intelligence requirements which necessitate tasking of non-organic intelligence collection assets. EAC, as currently envisioned, would not duplicate the all-source analysis product from corps but rather would function as a fusion center for a multi-corps, sister service, national and collateral intelligence product for its area of interest. Additionally EAC is expected to act as the principal exploitation interface with the TRS for Air Force Photo (hardcopy) and may be required to provide NRT imagery exploitation for non-US Corps assigned to EAC in a joint and/or combined command.

(2) Corps.

Doctrinally the corps is the focal point for the integration of tactical intelligence data from all sources. All source intelligence products/reports will be provided by corps to division as well as EAC. The corps commander in order to concentrate forces must demand intelligence, in certain circumstances combat information, relating to the density of enemy forces, direction of enemy movement, and air defense disposition throughout his area of influence. Planning and management data is principally produced from the intelligence data at corps. The corps commander requires knowledge of the battlefield from his rear area to approximately 300 KM forward of the line of contact. This need to see deeper than ever before is the result of the enemy's strengths and offensive capabilities and our need to concentrate the right forces at the critical times and places. Knowledge of the known locations and extent of (1) 1st and 2d echelon and follow-on armies, (2) division/army/front and other nuclear delivery assets and (3) front supporting assets such as 2d echelon divisions is required. The corps commander requires intelligence necessary to (1) coordinate and support divisional battles, (2) plan and allocate resources for the battle 24-72 hours hence and (3) disrupt/destroy enemy assets which can influence that battle. FM 100-5 states, "the better he sees the battlefield, the more surely he will concentrate his forces at the right time and place." The corps commander utilizes his intelligence to find, identify, follow, and project enemy forces, and deployments prior to engagement. The increasing mobility, capabilities, and numerically superior enemy forces in the modern battlefield impose unprecedented requirements on intelligence collection platforms, intelligence processing systems and intelligence dissemination systems to acquire/reacquire forces/targets which have deployed to a field posture. Thus, intelligence resources must be applied rapidly and decisively in support of the commander's need to see the whole battlefield and his need to see it continuously from prior to the attack until the successful accomplishment of his mission. The corps commander must order the concentration of forces and order it in time to win. The corps commander requires intelligence faster than EAC. The timeliness requirement for intelligence data varies across the depth of the battlefield and is a function of the application of that data. This data will be used in support of target development in the 0-25 KM range beyond the FEBA, where timeliness requirements range from immediately up to 1 hour; in support of maneuvers to react to the enemy in the 0-50 KM range beyond the FEBA where the timeliness ranges from 1-2 hours and in support of planning in the 50 KM - 300 KM range beyond the FEBA where the timeliness ranges from 1-3 hours. NRT imagery can be sufficiently timely for corps exploitation requirements; can provide access to denied areas where the enemy's radar are uncooperative and not emitting; provides the most complete picture of the battlefield; and is the most accurate picture for the production of intelligence.

Imagery validates and complements intelligence data derived from SIGINT and HUMINT information and provides a confidence factor regarding derived data not found in other sources. A major role that can be satisfied by imagery is the need to isolate the heart of the critical node for targeting/kill purposes. Available data, drawn from existing studies, leads to the conclusion that only 50% of established critical nodes lend themselves to effective electronic templating. The remaining 50% must be isolated by other means. Imagery clearly does, or allows, this required isolation. Thus, imagery data in this role is invaluable to the commander.

(3) Division.

The division commander is deeply involved with the collection of combat information relative to movers, shooters and emitters, principally in the 0-25 KM range beyond the forward line of contact. The division commander has a pressing need for a properly correlated and analyzed, real time, picture of the battlefield. From his view of the battlefield the division commander determines whether to place fire on the target or to maneuver forces to repel the enemy. The division commander needs data on location of the 2d echelon division of the 1st echelon army. Additionally, the location of data is needed on the 1st and 2d echelon regiments of the 1st echelon division. The division commander's missions include: (1) coordination and allocation of support to brigade battles, (2) Planning and allocation of resources for the battle 12-36 hours hence, and (3) disrupting and destroying enemy assets which can influence that battle. The division commander requires knowledge of enemy divisional/army nuclear delivery systems. Knowledge of the battlefield from the division's rear area as far forward as 50-100 KM from the line of contact is needed by the division commander. Timeliness is most critical (even more so than at corps) at the division level because of the requirement to identify, locate and engage movers, shooters and emitters. The division receives all source intelligence information from the corps and further performs real time exploitation associated with organic SOTAS and data linked sensors.

D. Definitions of Terms Used in Matrix/Matrix Key.

(1) Imagery. The term "Imagery Exploited at that Echelon" applies to an intelligence product, of imaging sensor origin, which is in a format permitting the performance of the exploitation functions. This implies that any raw imagery collected data (usually in digital format) must be reconstituted in a format which will enable an interpreter to perform an exploitation effort producing useable information reports. The reconstitution of the raw data stream may occur at a location other than the exploitation location and the actual location may vary with different sensors' system configuration. Imagery by this definition therefore applies to an exploitable format only.

(2) Imagery reports derived by non-organic exploitation. The information can come from exploitation of several IMINT sources at EAC, corps, or CONUS. What is significant is that exploitation of these sources need not be organic to the echelon responsible for accomplishing a given function.

(3) Functions.

For the purpose of the study the following definitions of functional areas are used in the matrix.

(a) Battle Management: Inherent within the overall definition are the specific functions that incorporate several independent actions. The purpose of this discussion is to define what makes up battle management by function. These functions are: Sustaining the battle, Planning, Analysis, and Operation Security.

- Sustaining the Battle: Those actions required to resupply and reinforce tactical units to counter the battle engaged in or anticipated.

- Planning: The planning for allocation of forces against a scheme of maneuver incorporating mission(s), the enemy and friendly situations, weather, terrain, current intelligence estimates, intelligence preparation of the battlefield (IPB), SOP's, fire support, etc.

- Analysis: The detailed study of all source intelligence, use of IPB products, combat information, and critical node analysis, to determine enemy disposition and intentions.

- Operations Security Support: Those actions taken to determine friendly vulnerabilities to enemy intelligence collection.

(b) Battle Execution: Inherent within this overall definition are the specific functions of Maneuver and Fire Support.

- Maneuver: Those actions taken to move forces to engage the enemy. Functions inherent in this process are terrain analysis, weather, IPB, use of all source intelligence to include recon and surveillance reports with adequate lead time to cause friendly forces to execute proper reactions.

- Fire Support: Engagement of enemy targets identified through combat intelligence and combat information by suppression of classification and location of critical nodes, e.g. indirect fire systems, C3 nodes, target acquisition elements, jammers and ADA elements).

E. Functional Evaluation of Imagery:

FUNCTIONAL MATRIX

FUNCTION	EAC	CORPS	DIVISION
Battle Management			
Sustain the Battle	E1	E2	E3
Planning	E1	E2	R4
Analysis	E5	E5	R4
OPSEC Support	E6	E6	E6
Battle Execution			
Maneuver	N7	E8	E8
Fire Support	N7	E9	E9

Key: E - Imagery Exploited at that Echelon.

R - Imagery Reports Derived by Non-Organic Exploitation.

N - Not Applicable.

Alphanumerics in Matrix refer to the following notes:

E1 - EAC does not require NRT exploitable imagery for this function due to lesser timeliness requirements. Hardcopy imagery exploitation is sufficient. Information can also be derived from non-organic exploitation elements outside of theater or from the corps.

E2 - Timeliness is the prerequisite for imagery at this echelon to permit the commander to allocate his forces in sufficient time to meet the threat. Continuously changing or additional EEI will require a more rapid response in intelligence production which indicates exploitation at effected echelon. Imagery will be used for confirmation and for more detailed target/activity identification.

E3 - Time is the most stringent aspect, and the division will be utilizing its real time assets to give the commander as much time possible to counter immediate threats. As these real time assets provide combat information for targeting purposes the ASAC can fuse it with other data to provide intelligence necessary to answer force concentration EEI.

R4 - The division will rely on imagery reports from corps to provide this data since this requirement is not as time sensitive as those that the division assets are collecting against and the area coverage is greater than that regularly covered by division assets.

E5 - Imagery is a major basis for the intelligence preparation of the battlefield. This data base is further expanded with the input from the all source production element. An accurate terrain analysis will reduce some of the uncertainties of battle by enabling the commander to focus on areas where the enemy forces may maneuver and mass. This analysis is not time critical, but must be performed on a frequent and continuous basis. Hardcopy and digitized imagery will provide required information.

E6 - Imagery is required in order to provide the commander that information necessary to indicate how his forces look to the enemy. The essential elements of friendly information necessary to accomplish this will probably differ considerably from that provided to cover enemy targets and will require considerable interaction between the requestor and exploiter. It is relatively non-time sensitive, and will utilize hardcopy imagery which will give better area coverage than softcopy.

N7 - This function is accomplished by corps not EAC. EAC actions that contribute toward the execution of this function are found in the planning and analysis phases of battle management.

E8 - The commander requires imagery intelligence to plan, coordinate and allocate his resources. Imagery will provide positive intelligence on enemy disposition and will permit the commander to concentrate his forces accordingly. Imagery can provide current terrain intelligence required for the commander to maneuver his forces in a most timely and efficient manner. The degree and depth of detail required are determined by the EEI stated. The enemy situation will be very fluid, changing constantly. Consequently, this function demands a close interoperative relationship between the requestor/user and exploiter. As the imagery is exploited against one set of EEI, additional EEI will be generated that could be answered by imagery already on hand, or which has just been exploited. Bonus information supplied by exploiters intimately familiar with the unit's operation often will generate additional EEI and requirements that can then be exploited immediately. There is also a

requirement for actual photography of selected targets/ objectives to be provided commanders/planners. These photos would be used as a map-supplement, may not be time-sensitive, do not need to be high resolution but must be from the most recent imagery available so as to accurately portray the objective.

E9 - Imagery and information is needed and time is very critical. The target is moving and/or has the capability to immediately inflict damage on friendly forces. Real-time or NRT data from any source can serve as the basis for targeting. However, due to the target location accuracy requirements, imagery is the only source that can currently provide geolocation data accurate enough to fire against. In some cases, imagery will be the verification source assuring the commander that a given target needs to be interdicted. The sources for this imagery will be those organic to the echelon and those in direct support of the echelon which have direct data links to the echelon. Exploitation is done by organic personnel. Timeliness and degree of detail are critical. The function includes target engagement by Lance missiles and by the Air Force.

F. There is an apparent requirement to transmit selected images between the various exploitation elements as well as from the corps down to its subordinate divisions and separate brigades. These images would not be for exploitation purposes, since their respective information content has already been transmitted; therefore, they need not be original quality and as such, some degraded quality similar to magazine quality would be acceptable. Examples of how this type could be used are to orient commanders on drop/landing zones, objective areas, and avenues of approach. Equipment to perform this task are the tactical facsimile devices being developed by TRI-TAC. They would be located at EAC, corps and division.

G. (1) Digital imagery comprises 98 percent of the imagery required at the corps level. The quality of this imagery is broken down as follows:

(a) Detect - 37 Percent
(b) Classify - 17 Percent
(c) Identify - 44 Percent

(2) To meet the requirements of the commander at EAC the quantity of imagery is broken down into 75 percent digital and 25 percent hard copy. The quality of imagery at EAC is as follows:

(a) Digital

(1) Detect - 53 Percent
(2) Classify - 1 Percent
(3) Identify - 46 Percent

(b) Hardcopy

(1) Detect - 0 Percent
(2) Classify - 0 Percent
(3) Identify - 100 Percent

(3) The source for this data is the USAICS WITCHCRAFT study. As operational concepts/mission profiles change and as RECCE systems-mix change there will be some shifts in these numbers. The study anticipated new systems, and sized them, in a generic sense, for the 1985 time frame, and so far known/projected changes have had only a minor effect on the figures as shown.

H. Conclusions: The analysis of the use of imagery resulting in the evaluations depicted by the matrix in Section II E, above, represents a combination of data from existing studies and the professional judgment of TRADOC. In the cases where the evaluation of a specific use is based on judgment alone, further analysis is required. Ongoing studies and planned future study efforts are designed to address these judgmental areas. At this point the conclusions drawn about the use of imagery and/or information derived from imagery are:

(1) Imagery needs to be exploited at division, corps and EAC.

(2) The primary form of imagery received, processed and exploited at corps and division should be near-real-time digital, all weather, day/night imagery.

(3) Exploitable imagery at corps supports the all source analysis activity at that echelon, provides for tip-off/cueing in a near-real-time manner and allows for immediate re-exploitation to meet the evolving information needs of the commander.

(4) EAC becomes the focal point for interface with USAF theater reconnaissance units that acquire conventional hardcopy silver halide photography.

(5) Some NRT imagery sensors which provide combat information for targetting should be organic to/exploited by division.

(6) Imagery provided to the corps in an NRT digital mode for exploitation at corps can meet the timeliness requirements of the corps commander, while reducing the communications dependence inherent with exploitation results being transmitted to the corps by message from a distant exploitation facility.

Section III. Concept of Employment/Exploitation.

A. The concept of employment of an imagery system and exploitation of imagery is based on:

(1) Hardcopy imagery will be primarily exploited by EAC.

(2) Softcopy imagery will be primarily exploited by corps.

(3) EAC may receive some softcopy and corps may receive some hardcopy.

(4) A single tactical imagery receipt, processing and exploitation facility capable of receiving imagery from any sensor functioning in a digital or analog mode is technically feasible.

(5) The MAGIIC is capable of handling the current/projected volumes of hardcopy photography that the AF Theater Reconnaissance units expect to provide during time of war.

B. The basic concept developed during this study effort is diagramed at Figure 2. Interface with USAF TRS units by an Army Image Interpretation unit organic to EAC is driven by the USAF procedure of support across the Theater rather than dedication of a specific squadron to a specific corps. Further, the USAF plans to acquire up to 50,000 feet of hardcopy silver halide photography per day in time of war. The vast volume of photographic information dictates Army involvement in its exploitation even though the timeliness of the conventionally acquired/processed and exploited photography is often inadequate for a corps commander's immediate battlefield information needs. The USAF expects and plans to operate conventional photographic reconnaissance systems into the 1990+ timeframe. The MAGIIC, as currently configured, is completely capable of providing the Army the means for utilizing this source of information. Thus, we foresee an Army element organic to EAC, collocated with the TRS.

C. Given the focus on all source intelligence and specifically NRT digital imagery we foresee the need for a tactical imagery exploitation system (TACIES) that receives, processes and exploits all digital imagery without regard to the collecting sensor or platform. We realize that current systems do not provide the required duration of coverage, time-

CONCEPT OF EMPLOYMENT/ EXPLOITATION

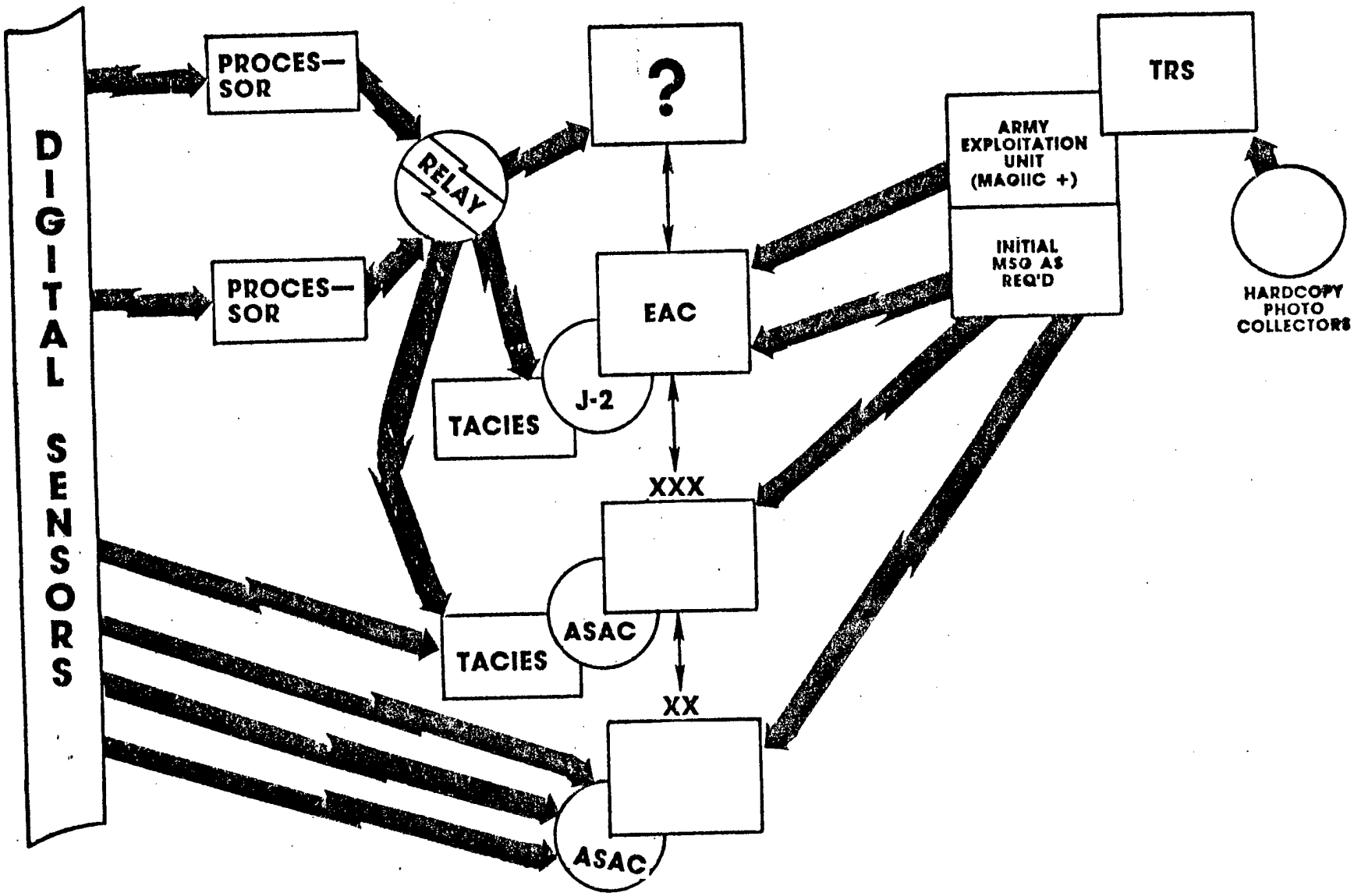


FIGURE 2

liness or desired re-visit times. However, these existing systems represent a first step toward more advanced systems which are expected to overcome these shortfalls.

D. Imagery exploitation at division is limited to real-time exploitation of organic/direct support collectors. Corps imagery exploitation would support the division's requirements that were of a lesser time-sensitive nature. The real time imagery data required by the division commander would be provided by SOTAS, and other data linked systems.

Section IV. Future Technological Requirements and Shortfalls.

A. This section will be completed at a future date following the results of analysis of Witchcraft, DEMONS, and utility of imagery studies/demonstrations. There are two shortfall areas that bear mentioning at this time, not to attempt to present any solutions but to highlight their importance and to solicit their early consideration as the system development begins.

(1) Multi-national interoperability.

This is basically an EAC requirement and mechanically presents a communications problem, but doctrinally is a security/releasability of information task. It obviously is not applicable in US-only operations; however, it is a reality in Europe and Korea today and must be considered for future systems.

(2) Communications.

Communications necessary to support the imagery exploitation effort will be a critical part of the exploitation system. A reliable, highly available communications system with diverse routing will be required for tasking, cueing, and dissemination between division, corps, and EAC. At EAC this communication system must have a multi-national capability. Current communications systems will not be adequate to handle the traffic envisioned in this concept.

B. As we proceed through the validation plan outlined in Section V below, additional shortfalls will be addressed. The solutions may in fact be technologically feasible but a major concern which must be a part of our analysis of each shortfall, as well as the entire area of imagery, is cost versus results.

C. An evolving concept from the ongoing DIV 86 study relative to surveillance/fusion indicates that future technologies applicable to any new intelligence collection and processing system must focus on two distinct but interrelated command missions (Figure 3). The

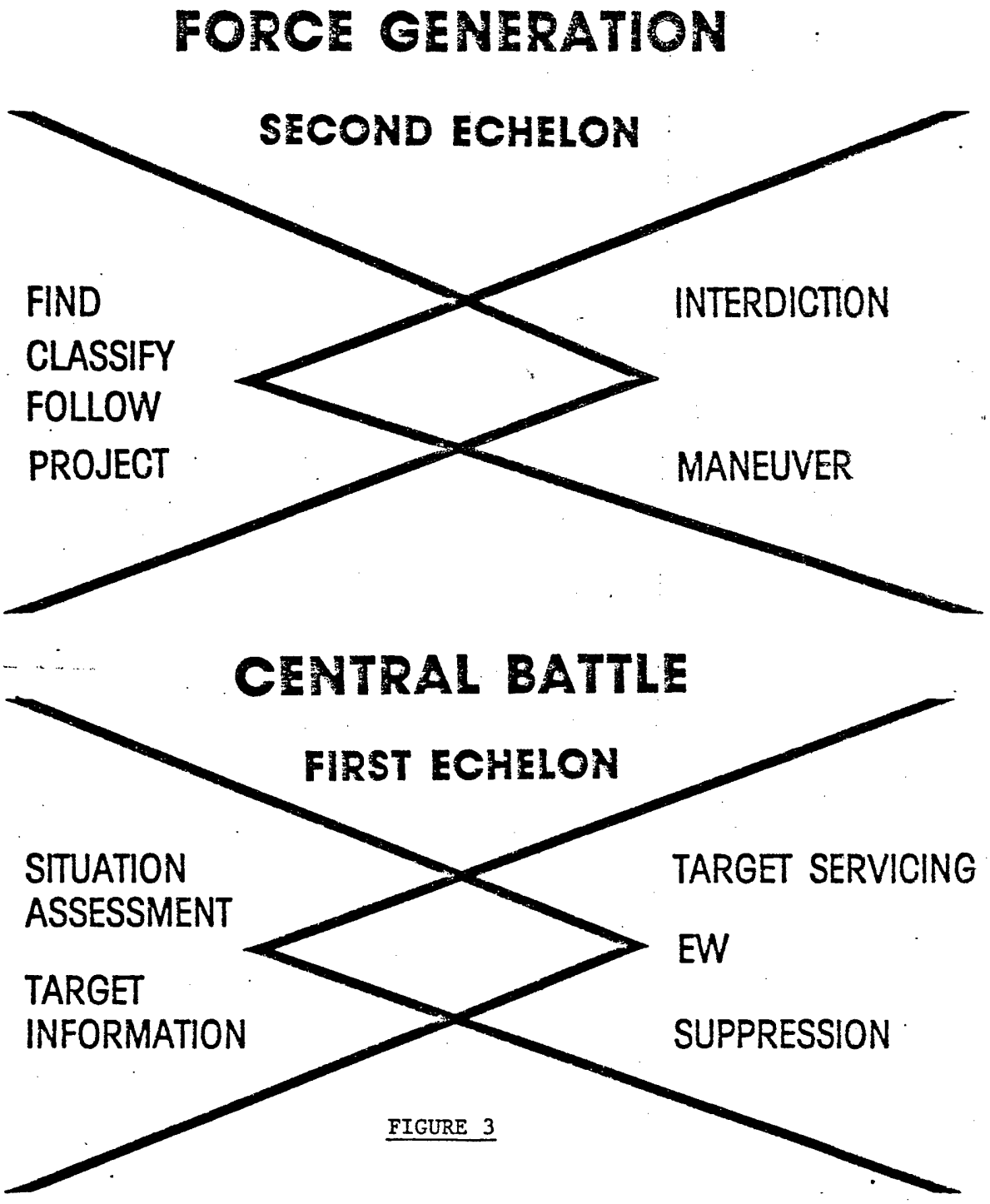

FORCE GENERATION
SECOND ECHELON
FIND
CLASSIFY
FOLLOW
PROJECT
INTERDICTION
MANEUVER
CENTRAL BATTLE
FIRST ECHELON
SITUATION ASSESSMENT
TARGET INFORMATION
TARGET SERVICING
EW
SUPPRESSION

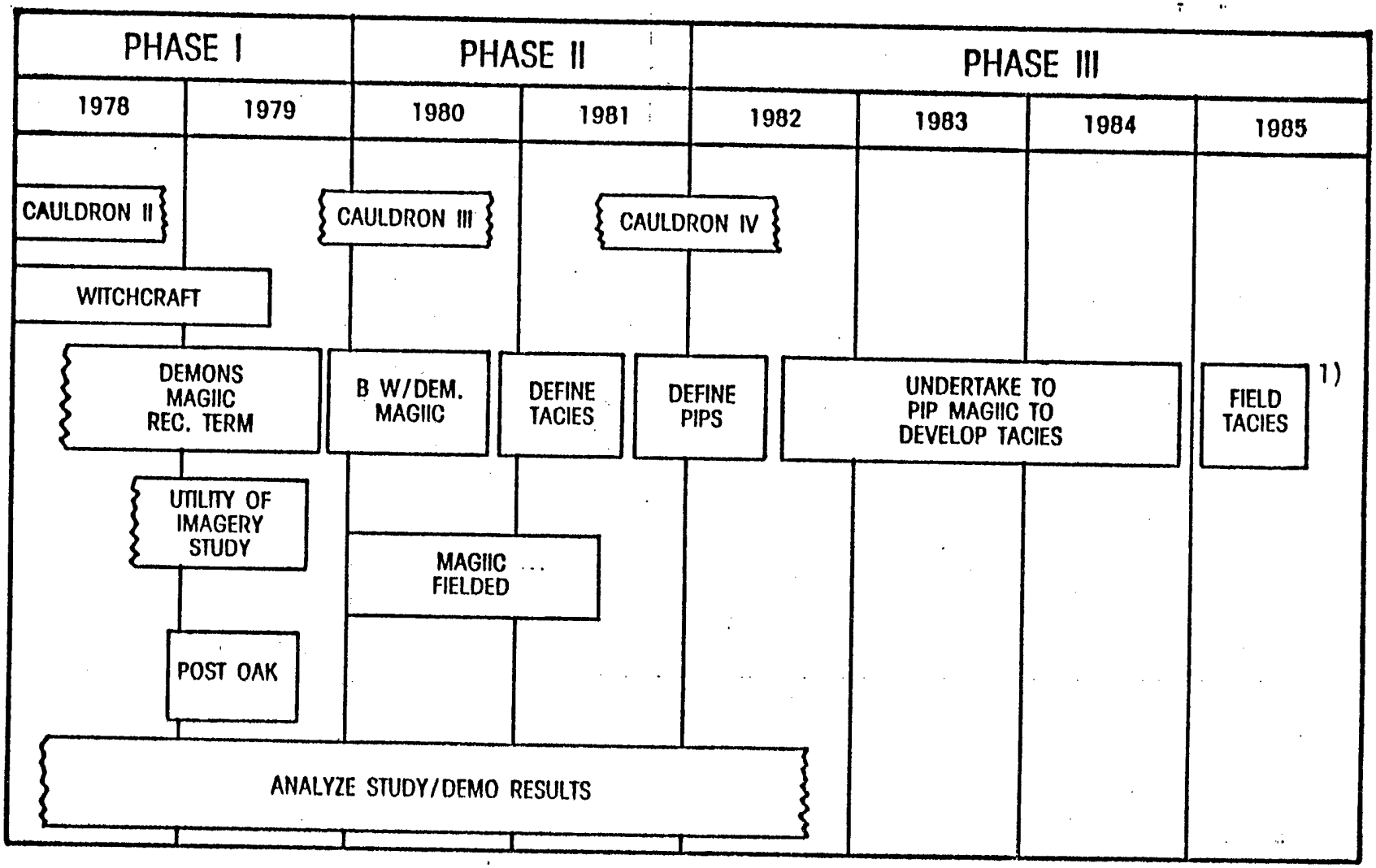
FIGURE 3

first of these is the commander's responsibility to allocate his forces (Force Generation). For intelligence systems to support the commander in the accomplishment of this mission they must find, classify, follow and project the enemy second echelon forces in order to allocate/maneuver the friendly defenses and to interdict the enemy at the greatest possible depth so as to disrupt the timing/coordination of the attack. The second mission is the requirement to fight the Central Battle. Intelligence systems must allow for situational assessment and acquisition of critical node targets in support of target servicing, electronics warfare and suppression of enemy air defense (SEAD). As we undertake planned imagery studies/tests in the next year, this concept, as well as others, must be a major part of our analysis.

Section V. Validation.

We recognize that there are many questions yet to be answered relative to imagery exploitation, processing and receipt. At this point in time, these questions cannot be adequately addressed with empirical data and subjective answers are no longer acceptable. Therefore, this study is interim in nature. Our plan to develop a completed analysis of the entire set of questions has been firmed up and drawn together. We will move through three phases to that goal . Phase I, which is already funded and underway will see a demonstration/test of DEMONS, MAGIIC and a brassboard imagery processor, the Receive Segment, at Fort Belvoir in the summer of 1979. DEMONS is a softcopy imagery exploitation system. The two-year Witchcraft study relative to the type of image exploitation system needed by the Army in the 1985 timeframe will be completed. A second study designed to test the utility of imagery at the tactical level is being scheduled. In this effort we will evaluate varying corps imagery options ranging from organic exploitation of imagery through receipt of exploitation messages. Phase II will see the DEMONS/Receive Segment/MAGIIC included in the 1980 BETA test in Europe. Phase III will draw from the results of Phases I and II and will see the identification of required developmental improvements leading to a TacIES (Figure 4). The advantages of this approach are threefold. One, we may PIP the MAGIIC to a single imagery receipt, processing and exploitation system. Thus, we would not need to develop a new system from scratch thereby avoiding a long-term development cycle. Secondly, we will learn through actual experimentation and hands-on use what is required and, as importantly, what is not required. In this manner we will deal from an objective, analytical base of empirical data rather than subjective conceptualization. Thirdly, we will, with the systematic planned approach outlined above, more effectively manage our own resources. Thus, we are confident that our planned approach to the remaining problems/questions relative to imagery will, once and for all, establish hard factual data that will allow us to take advantage of the technological environment of 1985 and beyond.

VALIDATION OF ARCHITECTURE



1) A 28 August 1979 change forecasts fielding of TACIES in 1988.

FIGURE 4

Section VI. Conclusions.

A. We have already concluded that imagery needs to be exploited at the EAC, corps and division; that imagery to be exploited at the corps must be near real-time digital imagery; that corps' principle source of imagery for exploitation should be in softcopy while EAC's should be hardcopy; and that EAC should be the Army interface point with the USAF TRS. (Reference Section II F(1) thru (6)).

B. We recognize that the ability to communicate is equally as important. Further, we realize that transmission of digital data is, in itself, a major communications problem to be solved. (Reference Section IV).

C. The need for a solution to allied interoperability problems must be addressed. The war of the future will inevitably be fought in a multi-national environment and we must plan our intelligence capabilities with that in mind. To do so with reconnaissance systems requires a concentrated effort towards achieving a solution to this problem (Reference Section IV).

D. We are convinced that a single tactical imagery receipt, processing and exploitation system is feasible by 1985 and that our three-phase validation plan outlined in Section V will define our specific design requirements. Further, we believe that we will develop empirical data supporting our conclusions on imagery exploitation.

Section VII. Recommendations.

A. That the three-phase validation plan contained in Section V be funded and undertaken.

B. That a follow-up study/report be prepared analyzing the results obtained during Phase I.